Multi-Resolution Changes in the Spatial Extent of Perennial Arctic Alpine Snow and Ice Fields with Potential Archaeological Significance in the Central Brooks Range, Alaska

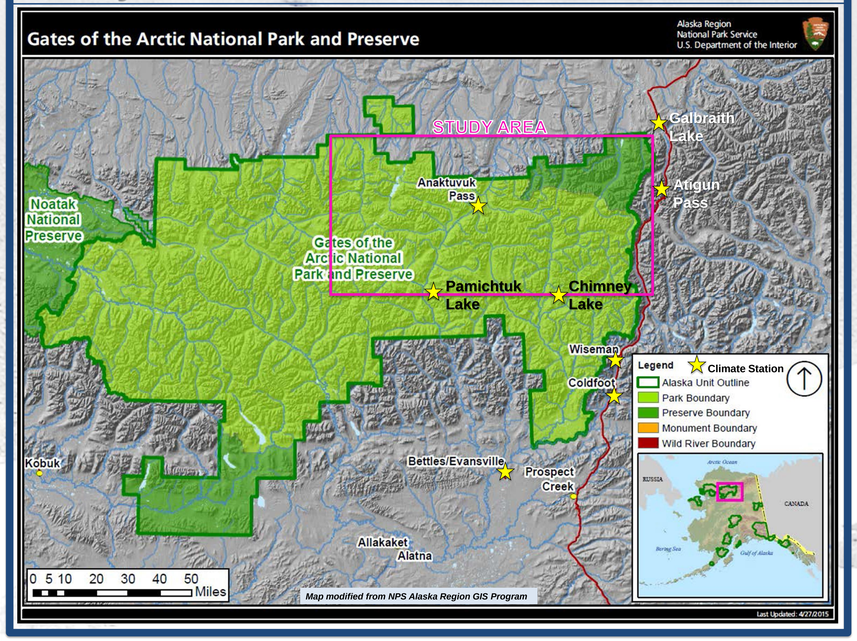
Molly E Tedesche[1], Adam K Freeburg[2], Jeffrey T Rasic[2], Christopher Ciancibelli[2], and Steven R Fassnacht[3]

[1]International Arctic Research Center and Water and Environmental Research Center, University of Alaska Fairbanks
[2]Gates of the Arctic National Park and Preserve, Fairbanks, Alaska
[3]Watershed Science, Ecosystem Science and Sustainability, Colorado State University

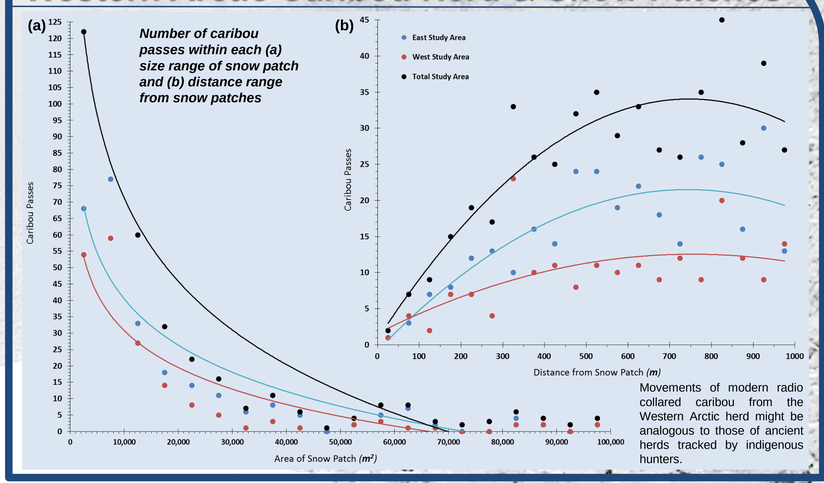
INTRODUCTION

Perennial snow and ice fields could be important archaeological and paleoecological resources for Gates of the Arctic National Park and Preserve in the central Brooks Range of Alaska. These features may have cultural significance, as prehistoric artifacts may be frozen within the snow and ice. They also act as important hydrological indicators of climate change within the Park. Globally significant discoveries have been made recently as ancient artifacts and animal dung have been found in melting alpine snow and ice patches in the Southern Yukon (Hare *et al.* 2004) and Northwest Territories (Meulendyk *et al.* 2012) in Canada, as well as in the Wrangell mountains in Alaska. The loss of perennial snow and ice coverage in the Brooks Range may yield similar discoveries over time.

Study Area in Gates of the Arctic National Park



Western Arctic Caribou Herd & Snow Patches

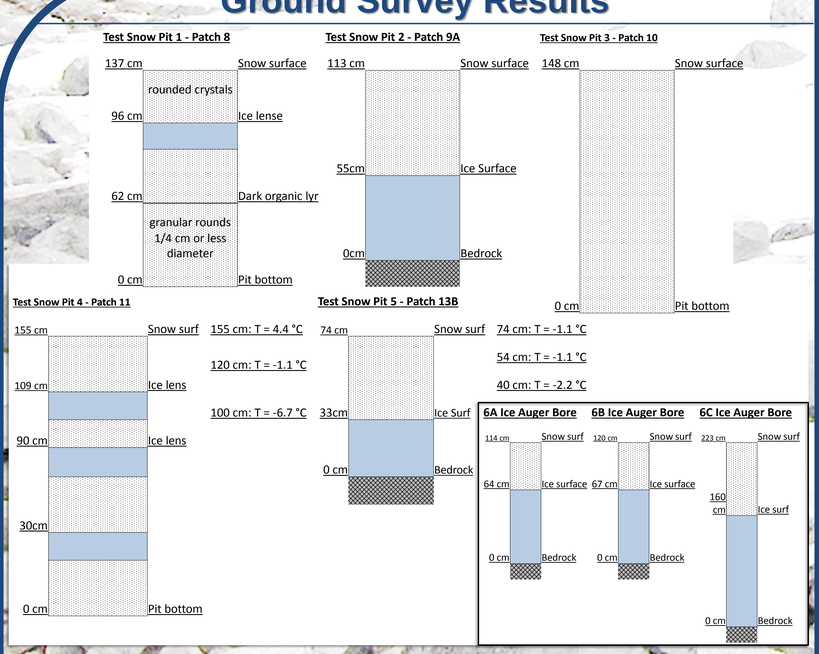


Movements of modern radio collared caribou from the Western Arctic herd might be analogous to those of ancient herds tracked by indigenous hunters.

Proposed Future Research

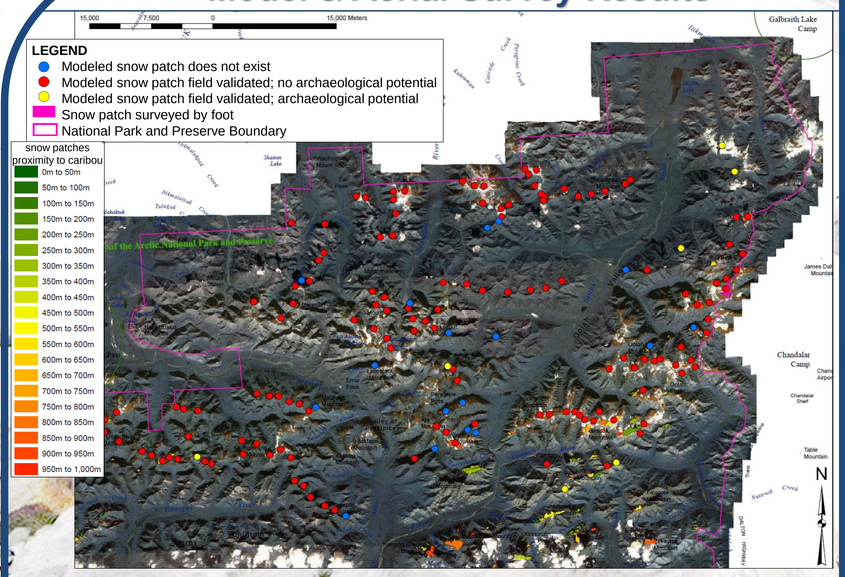
Further work is ongoing to develop a model to guide snow and ice field surveys, as well as to inform local subsistence caribou hunters. This work will entail an empirically based model of changes in geometries of perennial snow and ice fields. In order to model former extent of the fields within the study area, lichen vegetation and geologic trim lines will be used to derive former positions, maximum extents, and former equilibrium line altitudes (ELAs) using the satellite and aerial imagery (Wolken *et al.* 2008). Future field work will entail ice coring and ground penetrating radar (GPR) to measure snow depths.

Ground Survey Results



Twenty mid to high elevation sites were surveyed by foot in July 2015. Sites visited by foot were targeted for survey based on an archaeological model combining Landsat imagery of snow patches with proximity to aggregation locations of radio-collared caribou. No archaeological specimens or ancient dung were recovered, however, well-preserved animal and plant remains were found.

Model & Aerial Survey Results



Aerial survey of 160 snow patches was accomplished by helicopter. Initial results indicate good agreement in permanent snow and ice cover between field surveyed data and the 1985 to 2011 Landsat imagery-based Northwest Alaska snow persistence map (Macander *et al.* 2015); 17 out of 160 surveyed snow patches were found to be non-existent, with those typically located on the steepest slope angles.

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National Park Service Climate Change Response Program's Young Leaders in Climate Change (YLCC) 2015 Fellowship
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